



Interaction of pubertal development and metabolic control in 1303 adolescents with Diabetes mellitus type 1

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Objective

Is pubertal growth spurt associated with an increase of HbA1c? Are there gender differences in metabolic control during puberty? Is pubertal growth spurt impaired in patients with T1DM compared to German reference data?

Background

In T1DM growth and pubertal development exert mutual influences. Delayed pubertal development and reduced final height are associated with inadequate metabolic control. Factors including reduced insulin sensitivity during puberty and insufficient adherence may be responsible for an increase in HbA1c.

Methods

1303 complete longitudinal patient data out of a Diabetes follow up program could be analysed over a period of nine years. Inclusion criteria were continuous recording of height and HbA1c every six months from the age of 7 to 16 years in patients with T1DM. Exclusion criteria were celiac disease, eating disorders, steroid or growth hormone therapy, less than 3 months duration of disease, BMI < 3rd or > 97th percentile at start of documentation.

Results I

Metabolic control

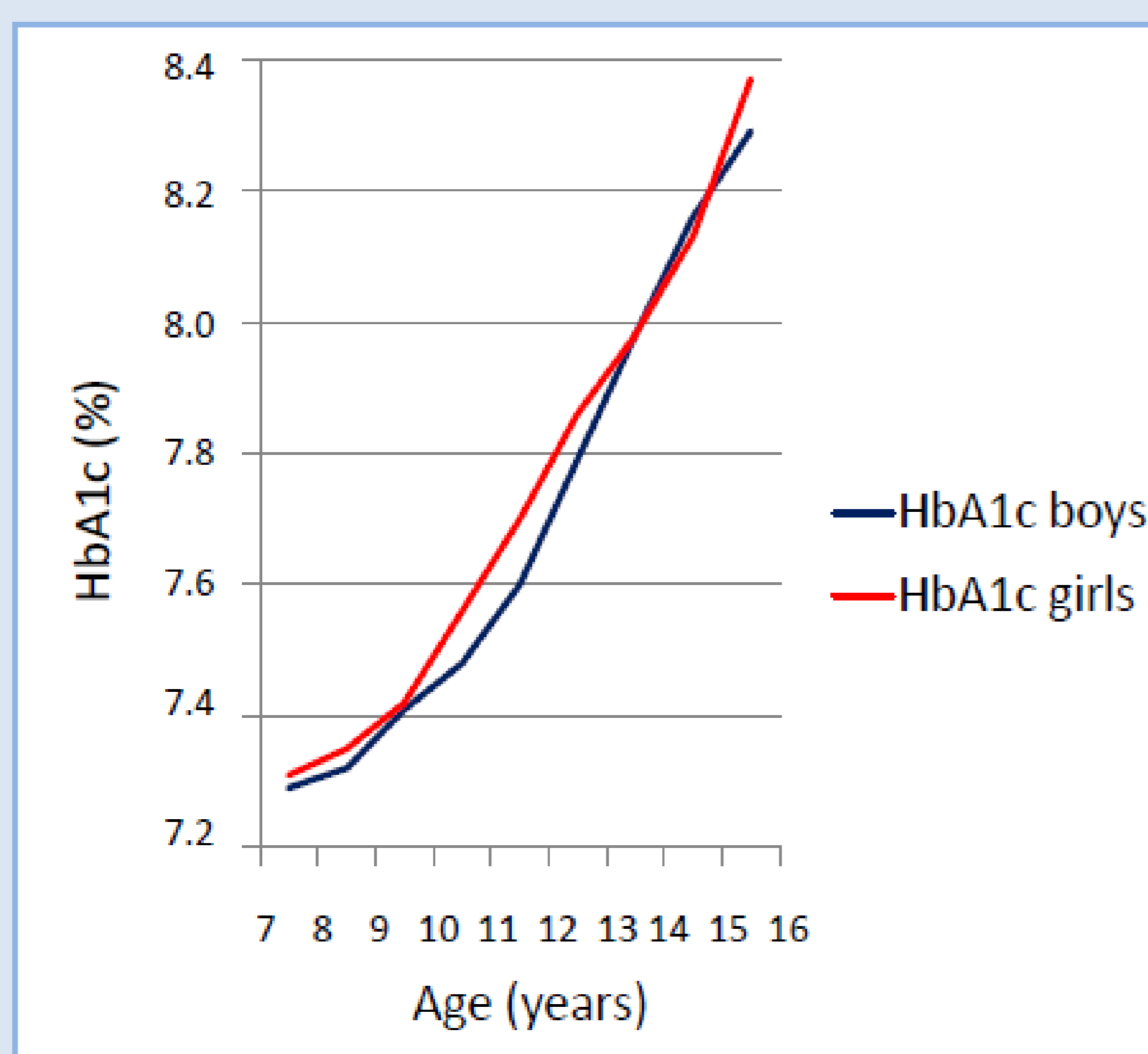


Figure I
Development of HbA1c
In girls and boys with
T1DM during puberty

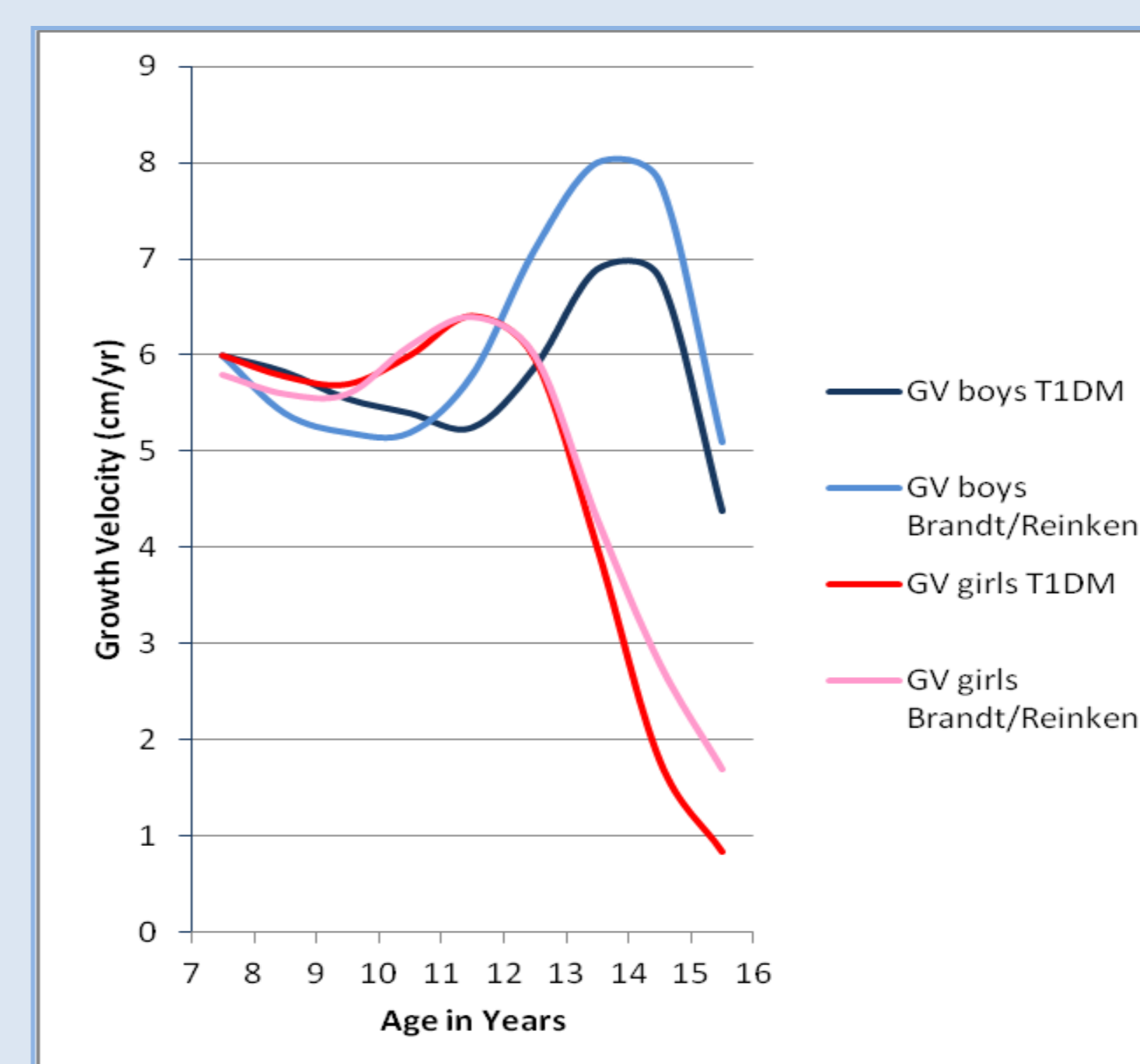


Figure II: Growth velocity of girls and boys with T1DM compared to German Reference Data¹

HbA1c

- HbA1c levels increased from 7.3% (7 years) to 8.4% (16 years).
- From 10 years onward HbA1c was lower in boys except for a period of 1.5 years (13.5 to 15 years)
- Highest HbA1c increase in boys (Δ 0.38%): between 12-14 years \rightarrow time of maximum growth spurt.
- In girls main HbA1c increase (15-16 years) \rightarrow postpubertal

Growth velocity

- We compared growth velocity of T1DM patients with data from a healthy German control group¹
- In diabetic boys median growth velocity at time of maximal growth spurt was reduced by 1.1 cm
- In girls with T1DM maximal growth spurt was not impaired, but growth velocity declined more rapidly than in the healthy control group after growth spurt

Results II

BMI-SDS

- BMI-SDS was higher than BMI-SDS of German reference data²
- Diabetic girls had a higher BMI-SDS than boys, which became increasingly obvious after the age of ten

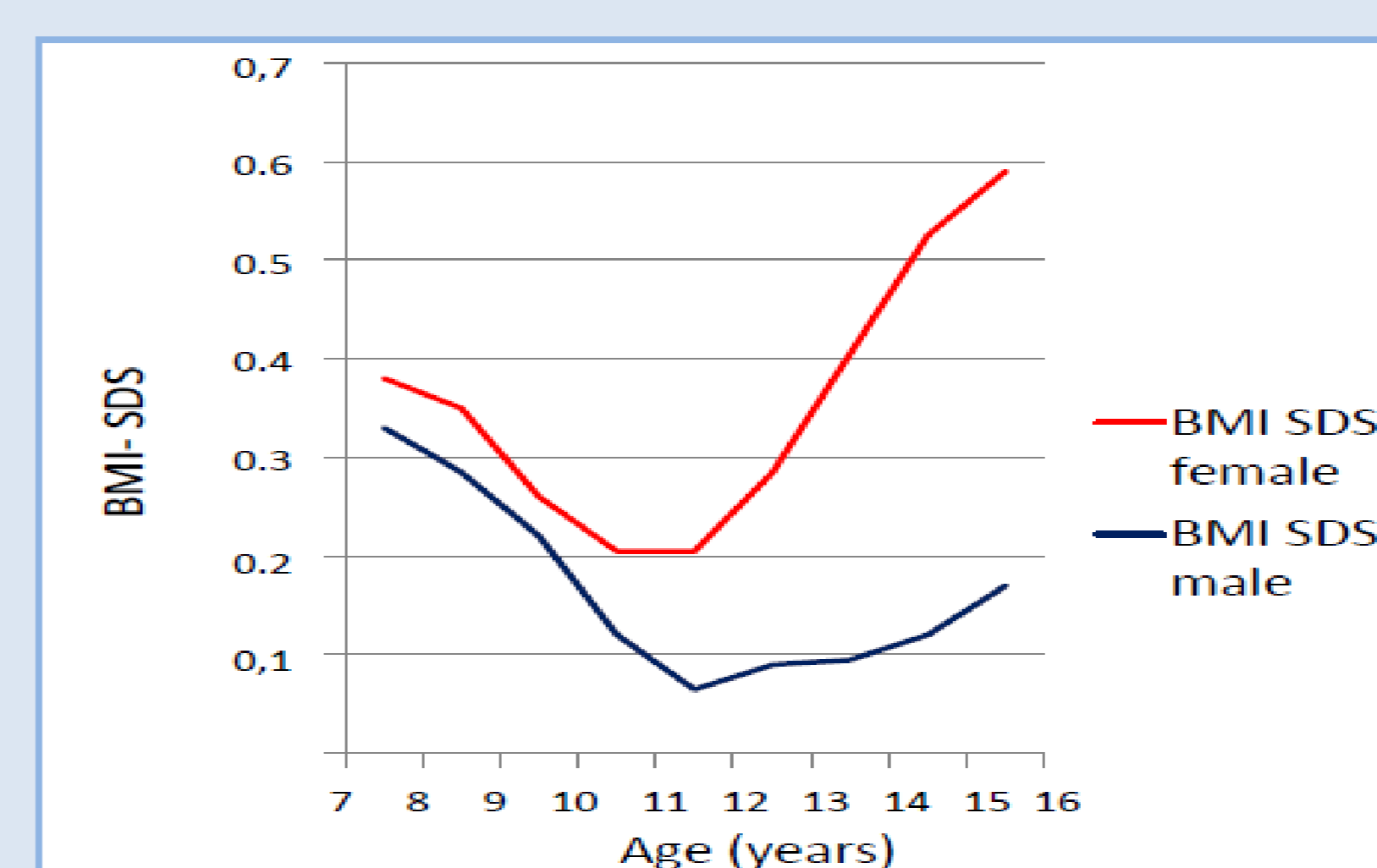


Figure III: BMI-SDS development of boys and girls with T1DM during puberty

Conclusion

The increase in pubertal HbA1c is caused by a complex interaction of physiological and psychological factors, and HbA1c increase in turn influences growth by reducing growth velocity in boys and girls. Care of patients with T1DM during puberty requires an enormous effort of patient, family and health-care team to deal with the chronic disease, but also to improve the puberty-related risks for height development and metabolic control.